Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

CONTRIBUTIONS ON THE LIFE HISTORIES OF CERTAIN SNAKES.

GEORGE E. BEYER,

TULANE UNIVERSITY OF LOUISIANA.

IN reading over the magnificently compiled monograph of the poisonous snakes of North America by Mr. Leonhard Stejneger, and also an article on the breeding habits of snakes by Dr. O. P. Hay, in the *Proceedings of the U. S. National Museum* (Vol. 15, 1892), I find many points of character as well as of the reproduction which appear, according to both writers, very obscure.

My observations, extending over a period of nearly twenty years, were made principally on ophidians, occurring in central Europe, Central America, and our southern states, chiefly Louisiana, and were conducted both in nature as well as confinement, the latter especially with a view to note the extent of the exceedingly limited mental capacity and the development of their sense organs. I have noted the entire period of gestation of at least three of our venomous snakes from the time of sexual union to the end of the term, and I dare say with comparative certainty that the same length of gestation occurs as well in *Natrix rigida* and *Natrix grahamii*.

The term of gestation may vary to a limited number of days, but all my notes point to five months and a few days.

While searching for reptiles in the vicinity of New Orleans on the 10th of March, 1893, I happened to come across a pair of *Agkistrodon piscivorus* in coitu, which must have, evidently, been nearly or quite completed, for the male freed itself so quickly that I failed to secure it, but the female, an unusually large one, became my captive.

She proved to be a very aggressive and obstinate individual for quite a long time, and refused food persistently for fully two months. The cage in which I kept her was prepared with some imitation of natural surroundings, and after the expira-

tion of about two months the snake commenced to feed on mice, and before another month passed by she swallowed pieces of raw beef and fish with avidity. I continued to feed her at the point of a little stick fairly regularly every two or three days. About four months from the day I caught her I noticed an increase in her size, but, of course, I could hardly credit my surmise at first. On August 17, however, she produced nine young ones. She killed one by lying on it, but the other eight were lively, in markings the same as the mother, but more distinct, and the ground colors much more reddish and brighter. To test their poisonous qualities I permitted one of them to bite me on the following day, but outside of the peculiar penetrating sensation attendant upon all venomous snake bites, and not unlike a bee sting, I did not feel other results. The young snakes measured exactly six and three-eighths inches in length, and in their thickest diameter four-fifths of an inch. The mother and five of her babies are now in the collection of Tulane University, all having died the following winter.

The winter of 1893–94 proved quite severe up to the end of February, 1894, and reptiles did not appear until then; but when I came to Avery's Island, on the last day of March, Mr. E. McIlhenny had collected for me a number of snakes, among them a full-grown ground-rattler (*Sistrurus miliarius*).

As soon as I reached New Orleans again, a few days later, I prepared a suitable cage for that snake. The first mouse I offered was killed and swallowed with the greatest promptitude. The deportment of this little rattler was not at all vicious, and after a short while would pay but little attention to what was going on in and about the cage; she even showed no signs of irritability if I accidently touched her with my hand while removing her water pan or cleaning out the cage. But I never succeeded in getting her to eat anything except mice. Toward the middle of July I noticed a gradual increase in her size, especially in the posterior portions, and on August 12 she gave birth to six little ones. They were born during the night, and I found each one of them curled up in the manner of the old one in different places in the cage. The newcomers were

the exact counterpart of their mother in color and markings, the ground color, however, much lighter, and the head being much more obtuse. Their length was five and one-half inches by a trifle less than one-fourth of an inch.

According to the condition of the weather and temperature, it is hardly possible that the snakes left their winter quarters before the beginning of March; mating must have taken place soon after, and, supposing it to have occurred about the middle of March, it will then determine the term of gestation to five months, or possibly a trifle over.

While on Avery's Island I captured, on April 1, two large water-moccasins. I kept the pair isolated from other snakes, but exactly thirteen days (August 25) after the birth of the ground-rattlers I came also in possession of eight young water-moccasins.

The same conditions as to temperature and the appearance of the snakes after hibernation prevailed in this case, and we find the term again to be five months and possibly a few days more.

In regard to the quotation of the notes on the pairing, etc., of *Agkistrodon piscivorus*, as observed by Effeldt in the Berlin Zoological Garden,[1] the period of gestation is considerably over five months. The dates, however, appear to have been noted with accuracy, and the excess of days in the period, if compared with my own notes, may be due to the climatic conditions under which the occurrence took place; but the statement of the size of the young at birth, as well as the color and markings, I believe to be unquestionably wrong. Our largest Crotalidæ never bring forth young of the length of ten and two-fifth inches, much less a water-moccasin.

On April 12, 1895, a negro came to me with an ordinary bird trap-cage. In it he had two magnificent copperheads, which he said he had caught on the previous evening in a cane-brake in the act of copulation. I purchased them and devoted considerable time to their care. Both of them accepted food very readily, and after awhile became gentler and more tractable, a trait which seems to me very much pronounced in copperheads,

[1] *Report of U. S. National Museum*, 1893, pp. 409, 410.

as I have found repeatedly illustrated in a number of other individuals of that species. I did not notice anything unusual until late in the evening of September 16, when the female (the larger one of the two snakes) brought forth seven young. These again were marked and colored like the parents, only more brilliantly. I have certainly no reason to doubt the negro's statement, especially as a later dissection proved the other snake to have been a male. The term of gestation is in this case again five months and four days. On May 3 of the same year some students brought me three specimens of *Natrix grahamii*, which they had caught in our university grounds. Two of the snakes were females. In September five young were born alive, while a sixth one remained dead in the membranous eggshell, although it had been expelled from the parent's body. I noticed that the food yolk of these little creatures was much larger and remained attached to them longer than in the young of the poisonous snakes.

In regard to *Eutænia proxima* and *E. sirtalis*, I am confident that, while, of course, the species are ovoviviparous as well, the number of young at one time is rarely more than eight or nine. Twice I have had young ones of that species born in confinement, at one time only five, at another, eight. They were five and three-fourths inches in length, and fully three-sixteenths of an inch in thickness. As to the term of gestation I am not certain, but pairing occurs in March and April, for I have had repeated opportunities to observe it in our swamps and palmetto thickets.

The structure of the membranous eggshell of all ovoviviparous snakes seems to be alike; it is very thin and perfectly transparent, and causes no difficulty to the young snakes to rupture it. The egg tooth, however, I have been able to find only in the young of *Natrix grahamii*. The motion of rupturing the inclosing membrane I saw very nicely demonstrated by the young of *Agkistrodon piscivorus*. The vertex lies close to the side of the wet and slimy shell; the simple motion of drawing the tip end of the nose upward and backward suffices to make an opening large enough for the little creature to crawl forth. All snakes shed skin from three to ten days after

birth. The food yolk remains attached for some time after birth, and *is not entirely absorbed before.*

There is certainly a grave mistake in Dr. H. C. Bumpus' account of *Eutænia sirtalis* (quoted in the *Proceedings of the U. S. National Museum*, Vol. 15, p. 388), for the genus Eutænia, as stated before, is ovoviviparous, and the young are marked just like the old ones, only much more brilliantly. Dr. Bumpus must have found the eggs of *Bascanion constrictor.*

According to the just-stated observations, the term of gestation seems to me definitely defined. At the same time we must also give credit to other statements, and the question arises, Do snakes copulate twice a year? Observations made by me in Europe on *Pelias berus*, *Vipera redii*, *Tropidonotus natrix*, and *Coronella lævis* seem to contradict such an assumption. In all cases, with the exception of *Vipera redii*, I have seen copulation in captivity, and I found the desire for reproduction to manifest itself in April and May, the young of Pelias and Coronella to be born in August and September, but the eggs of Tropidonotus to be laid in June and July. I placed freshly laid eggs of *Tropidonotus natrix* and *T. persa* in dunghills, and twenty-three days later I obtained the young ones. It is remarkable to notice the tenacity and intent with which the males persist in following up the females during the time of sexual desire.

How much I was mistaken in rating the toxic qualities of very young venomous snakes is illustrated by the following history of the bite of a young *Sistrurus miliarius.* As stated before in this article, I tried the effects of the bite of a young water-moccasin and experienced no results worth while mentioning.

During the noonday hour of Aug. 20, 1894, exactly eight days after the birth of the young ground-rattlers, I picked one of them up, teased it a little, and presented the first joint of the little finger of my right hand for a bite. The little snake bit with a vengeance. The momentary sensation resembled the sting of a bee; at the same time a lightning-like pain seemed to shoot up to the shoulder. A few minutes later actual pain extended to the second joint; a slight discoloration

around the wound, which, by the way, was scarcely perceptible, set in, indicating the destruction of the capillary walls and consequent extravasation. Œdema also made its appearance, and in a short while both swelling and pain increased in violence, extending gradually to the wrist and forearm, causing a numb sensation in the elbow joint, which sensation, however, disappeared again as the pains became more severe, and extended further up toward the shoulder. In less than an hour I was hardly able to raise my arm. Up to two hours after the bite the symptoms seemed to be merely local, but after that time they became systemic. General oppression and a slight degree of subjective vertigo commenced to be noticeable, both sensations increasing and remaining until after nightfall, and by eight o'clock dyspnœa became very troublesome. This feeling lasted until half past eleven, when I went to bed. The pain, however, which in the meantime increased in violence and extent, caused me to pass a sleepless night. By daybreak the swelling had extended well down my right side and upwards, even involving the same side of my face. Neither dilatation nor contraction of the pupil was noticeable. The pectoral region was extremely painful, but no such symptoms appeared in the scapular. The little finger was swollen to double its size, and the wound appeared like two black dots. The whole hand, as well as part of the forearm, showed upon pressure an exaggerated degree of resilience and heat. The temperature rose to one hundred and three degrees during the night, but by ten o'clock the following morning had subsided to ninety-nine and three-fifths. From that time on reaction set in, the symptoms gradually subsided, but an uncomfortable feeling throughout the entire system remained up to a period of thirty-six hours. After three days swelling and inflammation had almost all disappeared. Pains upon pressure, however, were noticeable as yet in the entire area which had been involved, and the discoloration in the axilla was very marked. Suppuration did not take place anywhere. No remedy had been applied from beginning to end.

The development of the sense organs in snakes leaves one in doubt at times just how far it extends. Sight is fairly good as

long as the object is moving; but I hardly think there is enough comprehension to distinguish a rat or frog as long as they will keep perfectly still. I have noticed that a snake will follow its victim around and around with its eyes, but, even if it should stop suddenly right in front of the snake and in convenient distance to strike, and keep perfectly motionless, the snake appears to be in doubt of its identity; the slightest muscular twitching in the victim, however, is then of course sufficient to overcome the uncertainty and hesitancy of the snake.

Smell is imperfectly developed, but it is amply supplemented by their exquisite feeling in the ends of the tongue. The sensitiveness of that organ is so fine that an absolute touch does not seem to be necessary, but the impression is conveyed to quite a long distance, sometimes for an inch or two. In regard to hearing, it is rather difficult to obtain accurate knowledge. At times it appears very acute, and at others no attention whatsoever is paid to sounds. If snakes are very alert and some noise is made, without disturbing the cage in the least and without making oneself visible, I found that they would catch up the sound waves very readily, and conveyed the fact by turning their head quickly in the direction of the sound and by their rapid display of the tongue.

The most careful and thorough observations, however, have so far not brought me to the solution of that bugbear of herpetologists, the use of the pit of the Crotalidæ and their next of kin, the moccasins. The assumption of the existence of a sixth sense is certainly easily maintained by the anatomical structure of the pit and the ramifications of the nerve in its linings.

On the life of some of our venomous snakes in captivity a few remarks may not be out of place. It is generally believed that they refuse food persistently and finally die of starvation. I have found, however, that the majority will accept living food without hesitation, as long as their receptacle is in any way arranged like their native haunts. The most interesting of our venomous ophidians I consider the copperhead, which in captivity becomes very tame, learning to take food, such as pieces of meat and fish, from the fingers. I possessed one some time

ago which would drink water out of a small graduated glass while I held it in my fingers. This snake learned to know very well that when I opened its cage door something in the line of food or drink was forthcoming. Several other copperheads that I kept at different times became quickly tame, and I found them easily satisfied with pieces of fish, which they preferred to beef. Water-moccasins became very tame also, but they are much more sluggish, and therefore less interesting. Of the latter I kept one pair nearly seven years in the cage. I suppose I would have them still if some one had not killed them by throwing boiling water on them when I was taken ill.

The greatest enemy of snakes kept in captivity I found to be a flat worm, shaped and colored almost like a leech, which penetrates all tissues. I found them at one time in the pericardium of a rattlesnake. Once these parasites manifest themselves, it is generally the death warrant to all snakes kept in confinement at the time. Another very troublesome and usually fatal affection appears in the shape of brownish-looking pustules; they are malignant, and the only chance in keeping the other snakes is isolation of the affected ones. I have seen a few recover by rupturing the pustules and sprinkling aristol on them.

In conclusion I may add that some weeks ago I received seven specimens of *Crotalus atrox* from San Antonio, Texas. Six of them are full grown; the other one is a small one of about eighteen inches in length, which is feeding lustily on Anolis. The venom of this little snake is evidently of considerable strength, for the death of the lizard ensues almost instantaneously after the bite. Three of the other six are evidently males. Sexual congress took place between one pair on May 14. The males are a little smaller and darker than the females. All are very excitable at present, any noise about the room being sufficient to start them to rattle. There seems to be absolutely no limit to their rattling. So far all of them have refused food. A young rat, which I put into the box, I had to remove again after two days, for the snakes never attempted to kill it.